

AMENDMENTS TO THE CLAIMS

1. (Currently amended) A voltage reference generator comprising:
a first bipolar transistor configured to amplify a base current of the first bipolar transistor,
the base current being proportional to an absolute temperature, ~~and~~
a resistor coupled to the base of the first bipolar transistor,
~~wherein~~ the base current ~~[[is]]~~ being proportional to a voltage difference between two
base-emitter voltages of bipolar transistors configured to have different current
densities, the voltage difference being formed across the resistor coupled to the
base and the base current being at least partially based on a resistance of the
resistor coupled to the base, and
a current mirror circuit configured to mirror a first current at least partially based on the
amplified base current and configured to provide the mirrored current to a voltage
reference node.
2. (Canceled)
3. (Currently amended) ~~The voltage reference generator, as recited in claim 1,~~ A voltage
reference generator comprising:
a first bipolar transistor configured to amplify a base current of the first bipolar transistor,
the base current being proportional to an absolute temperature, and
a resistor coupled to the base of the first bipolar transistor,
wherein the base current is proportional to a voltage difference between two base-emitter
voltages of bipolar transistors configured to have different current densities, the
voltage difference being formed across the resistor,
wherein a reference voltage produced by the voltage reference generator is proportional
to a parabolic function of temperature.
4. (Canceled)
5. (Canceled)

6. (Canceled)

7. (Original) The voltage reference generator, as recited in claim 1, wherein a power supply coupled to the voltage reference generator is less than 1.7V.

8. (Original) The voltage reference generator, as recited in claim 7, wherein a power supply rejection ratio of the voltage reference generator is at least 60dB.

9. (Currently amended) The voltage reference generator, as recited in claim 1, wherein a reference voltage generated by the voltage reference generator is less than the bandgap voltage of silicon.

10. (Currently amended) The voltage reference generator, as recited in claim 1, comprising:

a second bipolar transistor, providing one of the two base-emitter voltages; and
a voltage reference node receiving a voltage based at least in part on the ~~voltage~~
difference of first current.

11. (Canceled)

12. (Previously Presented) The voltage reference generator, as recited in claim 10, wherein the first bipolar transistor provides the other of the two base-emitter voltages, and the second bipolar transistor operates at a current density different from the current density of the first bipolar transistor.

13. (Previously Presented) The voltage reference generator, as recited in claim 10, wherein the first bipolar transistor is a low-beta transistor.

14. (Previously Presented) The voltage reference generator, as recited in claim 13, wherein beta is less than ten.

15. (Previously Presented) The voltage reference generator, as recited in claim 13, wherein beta is less than five.

16. (Currently amended) The voltage reference generator, as recited in claim 10, further comprising:

a circuit coupled to the voltage reference node, the circuit generating a first voltage, the first voltage being proportional to a complement of the absolute temperature.

17. (Previously presented) The voltage reference generator, as recited in claim 10, further comprising:

an operational amplifier maintaining effective equivalence of a voltage on a node coupled to the first bipolar transistor and a node coupled to the second bipolar transistor.

18. (Previously Presented) The voltage reference generator, as recited in claim 17, wherein a noise component on the voltage reference node is substantially equivalent to noise of the operational amplifier.

19. (Previously Presented) The voltage reference generator, as recited in claim 10, wherein the integrated circuit includes a maximum of one feedback path.

20. (Currently amended) The voltage reference generator, as recited in claim 11, ~~further comprising:~~

~~a current mirror coupled to the voltage reference node, 1, wherein the current mirror mirroring mirrors~~ the first current without substantially amplifying the first current.

21. (Previously Presented) The voltage reference generator, as recited in claim 10, wherein the voltage is proportional to a parabolic function of temperature.

22. (Previously Presented) The voltage reference generator, as recited in claim 21, wherein the resistor has a value adjusting an effective slope of the reference voltage as a function of temperature.

23. (Previously Presented) The voltage reference generator, as recited in claim 10, wherein a power supply coupled to the voltage reference node is less than 1.7V.

24. (Previously Presented) The voltage reference generator, as recited in claim 23, wherein the power supply rejection ratio is at least 60dB.

25. (Previously Presented) The voltage reference generator, as recited in claim 10, wherein the voltage is less than the bandgap voltage of silicon.

26. (Currently amended) A method for generating a reference voltage comprising:
 developing a base current of a first bipolar transistor, the base current being proportional to absolute temperature;
 amplifying the base current; and
~~generating a reference voltage based at least in part on the amplified base current,~~
~~wherein the base current [[is]] being proportional to a voltage difference between a base-emitter voltage of a second bipolar transistor and a base-emitter voltage of the first bipolar transistor, the voltage difference being formed across a first resistor coupled to a base of the first bipolar transistor, the base current being at least partially based on a resistance of the first resistor;~~
mirroring a first current at least partially based on the amplified base current; and
generating a reference voltage at least partially based on the mirrored current.

27. (Canceled)

28. (Currently amended) ~~The method, as recited in claim 26,~~ A method for generating a reference voltage comprising:
developing a base current of a first bipolar transistor, the base current being proportional to absolute temperature;
amplifying the base current; and
generating a reference voltage based at least in part on the amplified base current,
wherein the base current is proportional to a voltage difference between a base-emitter voltage of a second bipolar transistor and a base-emitter voltage of the first

bipolar transistor, the voltage difference being formed across a first resistor coupled to a base of the first bipolar transistor,

wherein the reference voltage is proportional to a parabolic function of temperature.

29. (Previously presented) The method, as recited in claim 28, further comprising:
adjusting an effective slope of the reference voltage as a function of temperature
according to the first resistor.

30. (Previously Presented) The method, as recited in claim 26, further comprising:
maintaining substantial equivalence of a voltage on a first node and a voltage on a second
node with an operational amplifier, the first and second nodes being used to
develop the base current.

31. (Currently amended) The method, as recited in claim 26, ~~further comprising:~~
~~mirroring the amplified current, wherein the mirroring having~~ has an effective gain of
one.

32. (Original) The method, as recited in claim 27, wherein the first bipolar transistor is a
low-beta transistor.

33. (Original) The method, as recited in claim 32, wherein beta is less than ten.

34. (Original) The method, as recited in claim 32, wherein beta is less than five.

35. (Original) The method, as recited in claim 26, wherein the reference voltage is less
than the bandgap voltage of silicon.

36. (Previously Presented) The method, as recited in claim 26, wherein a power supply
coupled to the voltage reference node is less than 1.7V.

37. (Original) The method, as recited in claim 36, wherein the power supply rejection
ratio is at least 60dB.

38.-54. (Canceled)

55. (Currently amended) An apparatus comprising:

means for developing a current proportional to absolute temperature;

~~means for amplifying the current; and~~

means for generating a reference voltage based at least in part on the ~~amplified~~ current,

~~wherein the means for amplifying includes a first bipolar transistor, and~~

wherein the means for developing the current proportional to absolute temperature

~~includes a resistor coupled to a base of the,~~ a first bipolar transistor configured to

have a first current density, and a second bipolar transistor configured to have a

second current density different from the first current density,

wherein a voltage difference between two base-emitter voltages of the first and second

bipolar transistors configured to have different current densities being is formed

across the resistor, the resistor being coupled to the base of the first bipolar

transistor, and current through the resistor being substantially equal to the base

current of the first bipolar transistor.

56. (Previously Presented) The apparatus, as recited in claim 55, wherein the reference voltage varies according to a parabolic function of temperature.

57. (Previously Presented) The apparatus, as recited in claim 55, further comprising:

means for adjusting an effective slope of the reference voltage as a function of

temperature.

58. (Previously Presented) The apparatus, as recited in claim 55, wherein the means for developing the current proportional to absolute temperature includes the means for amplifying current and the means for amplifying provides one of the two base-emitter voltages of bipolar transistors.

59. (Previously Presented) A voltage reference generator comprising:

a first bipolar transistor configured to amplify a base current of the first bipolar transistor,

the base current being proportional to an absolute temperature,

wherein a base-collector voltage of the first bipolar transistor equals a voltage difference between two base-emitter voltages biased at different current densities.

60. (Previously Presented) The method, as recited in claim 26, wherein the first and second bipolar transistors are configured to have different current densities.

61. (New) The voltage reference generator, as recited in claim 59, wherein a reference voltage generated by the voltage reference generator varies according to a parabolic function of temperature.

62. (New) The voltage reference generator, as recited in claim 1, wherein the base current is inversely proportional to the resistance of the resistor.

63. (New) The voltage reference generator, as recited in claim 1, wherein the resistor is coupled between the base of the first bipolar transistor and a power supply node.

64. (New) The voltage reference generator, as recited in claim 10, wherein the first bipolar transistor provides the other of the two base-emitter voltages and the first and second bipolar transistors are pnp transistors configured in common-collector configurations.

65. (New) The voltage reference generator, as recited in claim 64, wherein the resistor is coupled between the base of the first bipolar transistor and the base of the second bipolar transistor.

66. (New) The voltage reference generator, as recited in claim 65, wherein the base of the second bipolar transistor is coupled to a voltage bias node.